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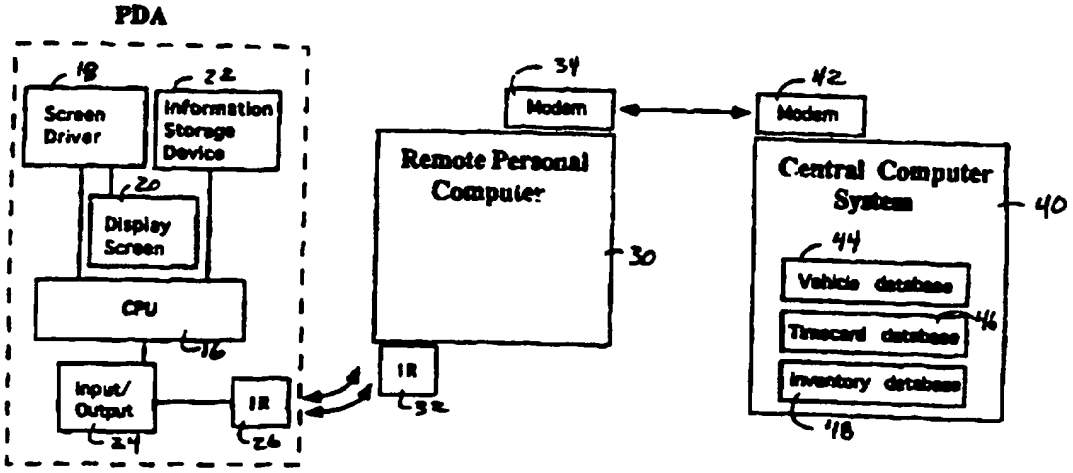


(57) Abstract

The present invention provides a system and method for coordinating maintenance, or other activities, for a plurality of motor vehicles, or other objects of a type subject to repeated need for the activities. The system utilizes an intelligent, hand-held, portable data entry and data processing device to display a schedule of activities for a plurality of objects as a menu of choices for selection, to store a record of activity for a selection, and to transmit the record of activity to update a database for the objects.

"METHOD AND SYSTEM FOR COORDINATING MAINTENANCE ACTIVITIES FOR A PLURALITY OF MOTOR VEHICLES"

Technical Field

The present invention relates generally to coordinating activities to be performed in connection with a plurality of objects, and more particularly to an improved system for, and method of, scheduling maintenance activities for a plurality of motor vehicles.

Background of the Invention

Transportation companies, such as United Parcel Service, comprise shipping networks that span vast geographic distances. To efficiently service such networks, transportation companies employ large fleets of motor vehicles dispersed at regional offices, or hubs, that operate with one another to ship parcels between various locations.

In continually transporting parcels, fleet vehicles receive heavy use. Accordingly, they require regular inspection and repair services to reduce breakdowns and increase vehicle life expectancy. Additionally, because vehicles do break down despite regular maintenance, fleet vehicles require unscheduled repair services to minimize time lost by such breakdowns.

The task of scheduling maintenance activities for fleets that comprise hundreds of vehicles is complex, typically requiring an entire department devoted to that purpose. Such vehicle departments typically operate from a central location and generate maintenance schedules for the regional offices. In addition to generating maintenance schedules, vehicle departments typically track vehicle histories, parts inventory, and mechanic

Summary of the Invention

The present invention seeks to provide a system for, and method of, coordinating activities for a plurality of objects, such as motor vehicles, of a type subject to repeated need for the activities, which displays a schedule of activities to be performed with respect to a plurality of objects as a menu of choices for selection, compiles a record of activities performed, and shares the recorded information with a remote computer.

In accordance with the invention, these objects are accomplished by providing a method and system for coordinating maintenance, or other activities, for a plurality of motor vehicles, or other objects of a type subject to repeated need for the activities. The system utilizes an intelligent, hand-held, portable data entry and data processing device to display a schedule of activities for a plurality of objects as a menu of choices for selection, to store a record of activity for a selection, and to transmit the record of activity to update a database for the objects.

Generally described, the present invention provides an intelligent, hand-held, portable device for coordinating activities of an organization. The intelligent, hand-held, portable device includes a processor connected to an input device for receiving information, a data transfer device for receiving and transmitting information, an information storage device, and a screen device for displaying information. The processor is configured to store a schedule of activities to be performed with respect to a plurality of objects and to display the schedule on the screen device as a menu of choices for selection.

The processor further stores a record of activity for a selection, and transmits the record of activity for updating a database for the objects. Preferably, the record of activity also includes time spent performing the activities, for updating a timecard database, and an accounting of inventory items used during the activities, for updating an inventory database.

In a preferred embodiment, the data transfer device is selectively operable to receive the schedule from a remote personal computer located at a regional office of an organization and to transmit activity records to the remote personal computer. The remote personal computer is equipped with a modem to receive the schedule from a central computer system and to

Fig. 2 is a diagrammatic view showing the information transmitted between the components of the system of Fig. 1 in accordance with the preferred embodiment of the present invention.

Fig. 3 is a logical flow diagram showing the sequence of steps for configuring a PDA and for transmitting information to and from the PDA in accordance with the preferred embodiment of the present invention.

Figs. 4A-4J are a sequence of screen displays from the user's perspective showing the process of configuring the PDA and of transmitting recorded information with the same in accordance with the preferred embodiment of the present invention.

Fig. 5 is a logical flow diagram showing the sequence of steps for performing scheduled maintenance with the PDA of the present invention in accordance with the preferred embodiment.

Figs. 6A-6J are a sequence of screen displays from the user's perspective showing the process of performing scheduled maintenance with the PDA of the present invention in accordance with the preferred embodiment.

Fig. 7 is a logical flow diagram showing the sequence of steps for performing unscheduled maintenance with the PDA of the present invention in accordance with the preferred embodiment.

Figs. 8A-8D are a sequence of screen displays from the user's perspective showing the process of performing unscheduled maintenance with the PDA of the present invention in accordance with the preferred embodiment.

Detailed Description

Referring to the drawings, in which like numerals refer to like parts throughout the several views, Fig. 1 shows the components of a system 12 for coordinating activities for a plurality of objects of a type subject to repeated need for the activities. It the preferred embodiment, the system 12 coordinates maintenance activities for a plurality of motor vehicles of an organization. It will be understood by those skilled in the art, however, that the system 12 can be used to coordinate maintenance activities for objects of many different types, and that it can be used to coordinate other types of activities.

The stylus can be a wand-mounted symbol reader. The wand-mounted symbol reader is preferably a model Scanteam 6180 by Welch Allyn. The wand-mounted symbol reader includes a light source and detector for reading bar codes as a tip of the wand is swept across a bar code. The tip is made of hard, transparent glass or plastic to withstand repeated drawing across surfaces on which bar codes have been printed. The wand-mounted symbol reader also includes a detector in the wand for detecting light reflected from a bar code and circuitry for decoding the detector output. A resulting signal containing the contents of the bar code is transmitted to the I/O circuit 24 via a cable plugged into a communications port of the PDA 14. The wand scanner may require a battery pack (not shown) for operating power. Wand-mounted symbol readers are well known devices and will not be further described herein.

In the preferred embodiment, the system 12 includes a remote personal computer 30 and a central computer system 40. The remote personal computer 30 is equipped with an infra-red port 32 compatible with the infra-red port 26 of the PDA 14. With appropriate programming of the PDA 14 and the remote personal computer 30, scheduling information can be downloaded from the remote personal computer 30 into the information storage device 22 of the PDA 14 via the infra-red frequency link. Additionally, information acquired by the PDA 14 can be uploaded into the remote personal computer 30. As alternatives to the infra-red link, data communication between the PDA 14 and the remote personal computer 30 may be over other known means, such as cable, radio frequency, or optical links.

The central computer system 40 generates scheduling information and includes a vehicle database 44, a timecard database 46, and a parts inventory database 48. The vehicle database 44 stores vehicle histories that allow analysis of vehicle performance and that provide mechanics with insightful information concerning the vehicles on which they are scheduled to perform maintenance. The timecard database 46 stores time spent by mechanics in performing various maintenance activities. The timecard database 46 allows the efficiency of the organization's mechanics to be tracked and labor standard times to be accurately set. The parts inventory database 48 stores an inventory of the parts stored at the regional offices.

the maintenance activities of the selection, he or she enters the maintenance activities performed and the parts used into the PDA 14. Simultaneously, the PDA 14 tracks the time being spent for the selected activity.

Upon completion of the selected activity, the mechanic enters a status of the selected activity and a record of activity is stored for the selected activity in the PDA 14. As used herein, the phrase "completion of the selected activity" means that the mechanic has completed working on the selected activity for the present time, not that the selected activity is finished. In the preferred embodiment, the record of activity includes the time spent, the maintenance activities performed and the parts used therein.

At the end of a shift, the records of activity are uploaded from each mechanic's PDA 14 to the remote personal computer 30 of his or her regional office. The records of activity are then transmitted from the remote personal computer 30 to the central computer system 40, in which the vehicle database 44, the timecard database 46, and the parts inventory database 48 are updated.

Fig. 3 is a logical flow diagram showing the process for configuring the PDA 14 and for transmitting recorded information with the PDA 14. Screen displays of the user process are shown by Figs. 4A-4J.

When the PDA 14 is activated, the process displays a main menu screen at state 50 from which a mechanic, or his or her supervisor, can select the time card, the transmit, or the utilities function. The main menu screen is best shown by the screen display of Fig. 4A.

Selections are made from the main menu screen, and from other screens, by touching the portion of the display screen 20 that defines a control of the desired function. In the preferred embodiment, a stylus is used to touch the display screen 20 when making a selection.

The utilities function allows a supervisor to configure the PDA 14. To prevent unauthorized tampering, a supervisor password is required to proceed from the main menu screen to the utilities menu. Accordingly, if the utilities function is selected, the utility branch of state 50 leads to decisional step 52 for validation of the password. The screen for entering the password is best shown by the screen display of Fig. 4B.

If the password is not valid, the NO branch of decisional step 52 returns to state 50 wherein the main menu screen is displayed. If the

personal computer 30 in response to actuation of an upload control on the display screen 20. Step 68 returns to state 54 wherein the utilities menu is displayed.

Returning to Fig. 4C, the utilities menu includes an exit function for leaving the utilities function. If the exit function is selected, the exit branch of state 54 returns to state 50 wherein the main menu screen is displayed.

The transmit function of the main menu screen is used by the mechanic to transmit and receive information. When the transmit function is selected, the transmit branch of state 50 leads to state 70. At state 70, the process displays a transmit menu from which the mechanic can upload daily timecard information or download maintenance schedules, corporate tables, and the like. The transmit menu screen is best shown by the screen display of Fig. 4G.

If the upload timecard function is selected from the transmit menu, the upload branch of state 70 leads to state 72. At state 72, the PDA 14 is set to transmit the mechanic's daily timecard information to the remote personal computer 30 via the infra-red link. The daily timecard information is transmitted in response to a command from the remote personal computer 30 when it is ready to receive the information. Upon completion of the transmission, state 72 returns to state 70 wherein the transmit menu screen is displayed.

If the download function is selected from the transmit menu, the download branch of state 70 leads to state 74. At state 74, the PDA 14 is set to receive files from the remote personal computer 30 via the infra-red link. Such files include weekly maintenance schedules and corporate tables with updated activity and part codes. The files are downloaded in response to a command from the remote personal computer 30 when it is ready to transmit the information. Upon completion of the transmission, state 74 returns to state 70 wherein the transmit menu screen is displayed.

The transmit menu includes an exit function for leaving the transmit function. If the exit function is selected, the exit branch of state 70 returns to state 50 wherein the main menu screen is displayed.

constantly record the time spent performing the maintenance. While performing the selected maintenance, the mechanic enters the parts used and the repairs performed for the selected maintenance through a series of intuitive screen displays.

At decisional step 90 it is determined if parts are used in performing the selected maintenance by querying the mechanic. The screen for querying the mechanic whether parts are used is best shown by the screen display of Fig. 6B, and is displayed throughout the activity for use either as parts are utilized or after completion of the entire task. If parts are used, the YES branch leads to step 92 wherein a part number is received. The screen for entering part information is best shown by the upper portion of the screen display of Fig. 6C.

As shown by Fig. 6C, the mechanic enters the part number with the stylus via a numeric keypad displayed at the bottom of the display screen 20. Alternately, if the stylus is a wand-mounted symbol reader, the part number can be entered by scanning a bar code of the part. At step 94, a dollar amount of the part is received.

Proceeding to step 96 a part failure code is received to characterize parts being replaced. The part failure code may be entered most conveniently by finding the part description in the scrolling menu provided at the middle portion of the screen shown in Fig. 6C, and selecting that part with the stylus. Step 96 leads to decisional step 98 wherein it is determined whether more parts were used. If more parts were used, the YES branch returns to step 92 wherein another part number is received on a reset screen as in Fig. 6C. If no more parts were used, the NO branch of decisional step 98 leads to decisional step 100. Additionally, if no parts were used at decisional step 90, the NO branch of decisional step 90 leads to decisional step 100.

At decisional step 100 it is determined if repairs were performed for the selected maintenance by querying the mechanic. The screen for querying the mechanic whether repairs were performed is best shown by the screen display of Fig. 6D. If repairs were performed, an operation code and a job description code must be entered. The YES branch leads to step 102 wherein an operation code of the repair is received. The screen for entering the operation code is best shown by the screen display of

are updated periodically by uploading the record of activity to the personal computer 30, which then uploads the record of activity to the central computer system 40, in a manner described above in connection with the utilities function. Step 114 returns to state 84 wherein the work schedule menu is displayed.

If maintenance repairs is selected from the work schedule menu at state 84, the repair branch leads to state 116. At state 116, a list of scheduled repairs are displayed as a menu of choices for selection.

In response to a selection by the mechanic, an internal timer is started at step 118 to contemporaneously record the time spent performing the maintenance. Step 118 leads to decisional step 90 for entering the parts used and the repair activities performed for the selected maintenance through a series of intuitive screen displays. The entry of information proceeds in the same manner as described above in connection with parts used and repairs conducted as a result of scheduled inspections originating at state 86.

Fig. 7 is a logical flow diagram showing the process for performing unscheduled maintenance. Screen displays of the user process are shown by Figs. 8A-8D. In the preferred embodiment, unscheduled maintenance is divided into unscheduled activities and breakdown activities.

If unscheduled maintenance is selected from the work schedule menu at state 84, the unscheduled branch leads to state 120. At state 120, a list of vehicles is displayed as a menu of choices for selection. The list of vehicles screen is best shown by the screen display of Fig. 8A. The list includes a selection for entering new vehicles. The screen for entering new vehicles is best shown by the screen display of Fig. 8B.

In response to a selection by the mechanic, by touching the "NEXT" button on the screen, an internal timer is started at step 122 to constantly record the time spent performing the selected maintenance. While performing the selected maintenance, the mechanic enters the parts used and the repairs performed for the selected maintenance through a series of intuitive screen displays.

Step 122 leads to step 124 wherein an operation code of the selected maintenance is received. Proceeding to step 126, a job description code of the selected maintenance is received. At step 128, a work

complete, the YES branch leads to step 154 wherein the internal clock is stopped and the time spent performing the scheduled maintenance is determined. Step 154 returns to state 84 wherein the work schedule menu is displayed.

If breakdown maintenance is selected from the work schedule menu at state 84, the breakdown branch leads to step 158 wherein an internal timer is started to constantly record the time spent performing the breakdown maintenance. Step 158 leads to step 160 wherein a breakdown memo number is received. The screen for entering the breakdown memo number is best shown by the screen display of Fig. 8C. As shown by Fig. 8C, the mechanic enters breakdown information with the stylus via a numeric keypad displayed at the bottom of the display screen 20.

At step 162, the date of the breakdown is received. At step 164, and referring to the screen shown in Fig. 8D, the time the breakdown call was obtained is received. The time the mechanic left to travel to the breakdown site is received at step 166. The time the mechanic arrived at the breakdown site is received at step 168. Step 168 leads to step 124 wherein an operation code of the breakdown repair is received. Breakdown information is stored in the information storage device 22 for later transmission to the remote personal computer 30.

In summary, the present invention provides a method and system for coordinating maintenance activities for a fleet of motor vehicles. The system utilizes an intelligent, hand-held, portable data entry and data processing device to display maintenance schedule for a fleet of vehicles as a menu of choices for selection, to store a record of activity for a selected activity, and to transmit the record of activity for updating a database for the vehicles.

Programmers of ordinary skill in the art will be able to provide software to carry out the specific functions described above. Furthermore, those skilled in the art will understand that the various steps of the present invention may include other error branches that cause the process to abort if an error condition exists in the PDA 14. Such error branches are well known in the art and are not directly related to the present invention. Accordingly, they will not be further described.

Claims

1. A system for coordinating activities, comprising:

an intelligent, hand held, portable device, including:

(a) an input device for receiving information;

(b) a data transfer device for receiving and transmitting information;

(c) an information storage device;

(d) a screen device for displaying information; and

(e) a processor coupled to said input device, said data transfer device, said information storage device, and said screen device, said processor being operative to:

(1) store a schedule of activities to be performed with respect to a plurality of objects of a type subject to repeated need for said activities;

(2) display said schedule of activities with said screen device as a menu of choices for selection;

(3) store a record of activity for a selection; and

(4) transmit said record of activity for updating a database for said objects.

2. The system for coordinating activities as recited in Claim 1, wherein said record of activity includes time spent performing activities of said selection for updating a timecard database.

3. The system for coordinating activities as recited in Claim 1, wherein a portion of said selections use inventory items and wherein said record of activity includes an accounting of said inventory items used in performing activities of said selection for updating a database for said inventory items.

10. A method for coordinating activities, comprising:

(a) receiving a schedule of activities to be performed with respect to a plurality of objects of a type subject to repeated need for said activities;

(b) displaying on a screen of an intelligent, hand held, portable device said schedule of activities as a menu of choices for selection;

(c) recording activity for a selection; and

(d) updating a database for said objects.

11. The method for coordinating activities as recited in Claim 10, wherein said record of activity includes time spent performing activities of said selection, further comprising the step of updating a timecard database.

12. The method for coordinating activities as recited in Claim 10, wherein a portion of said selections use inventory items and wherein said record of activity includes an accounting of said inventory items used in performing activities of said selection, further comprising the step of updating an inventory database for said inventory items.

13. The method for coordinating activities as recited in Claim 10, wherein said objects are a plurality of motor vehicles and said activities are vehicle maintenance activities.

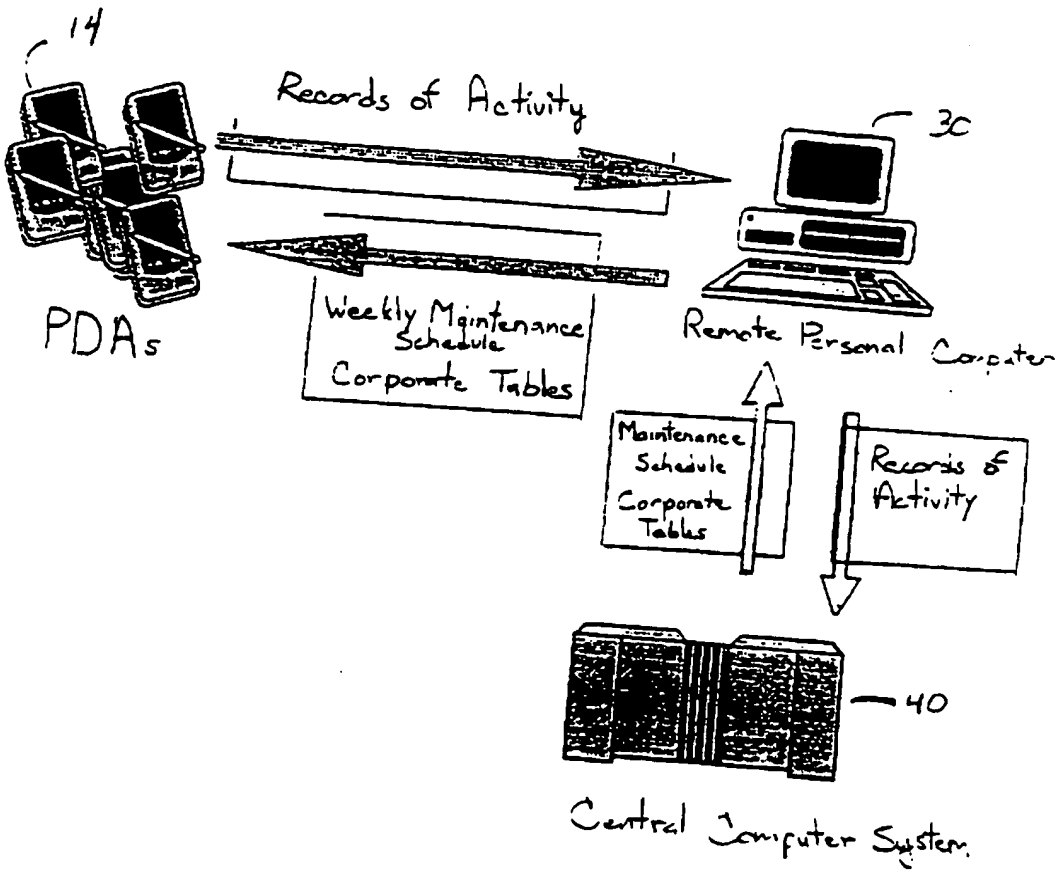

14
Records of Activity
30
PDAs
Weekly Maintenance Schedule
Corporate Tables
Remote Personal Computer
Maintenance Schedule
Corporate Tables
Records of Activity
40
Central Computer System

FIGURE 2

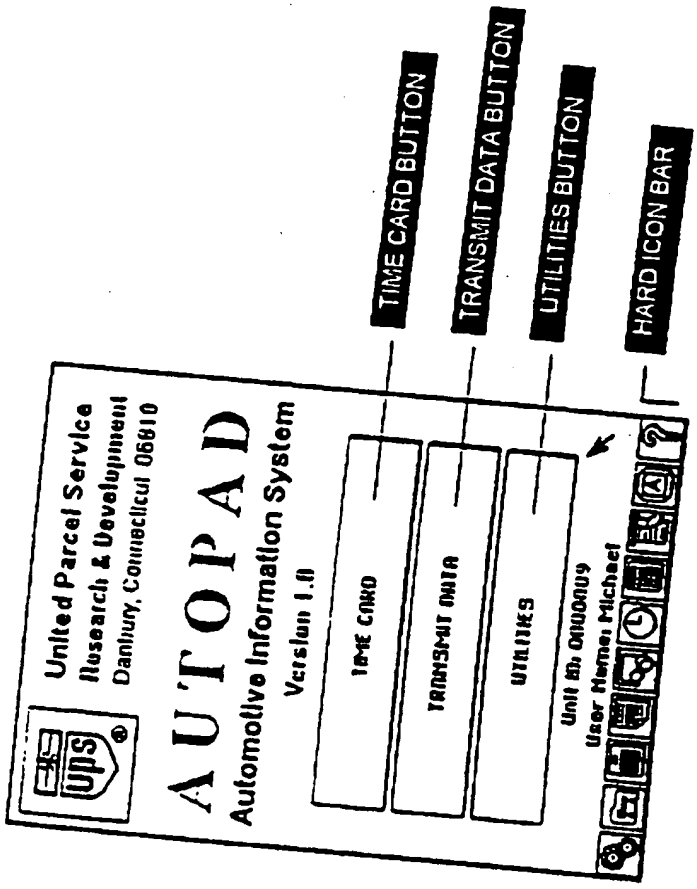

TIME CARD BUTTON
TRANSMIT DATA BUTTON
UTILITIES BUTTON
HARD ICON BAR
United Parcel Service
Research & Development
Danbury, Connecticut 06810
AUTOPAD
Automotive Information System
Version 1.0
TIME CARD
TRANSMIT DATA
UTILITIES
Unit ID: 0000000
User Name: Michael

Fig. 4A

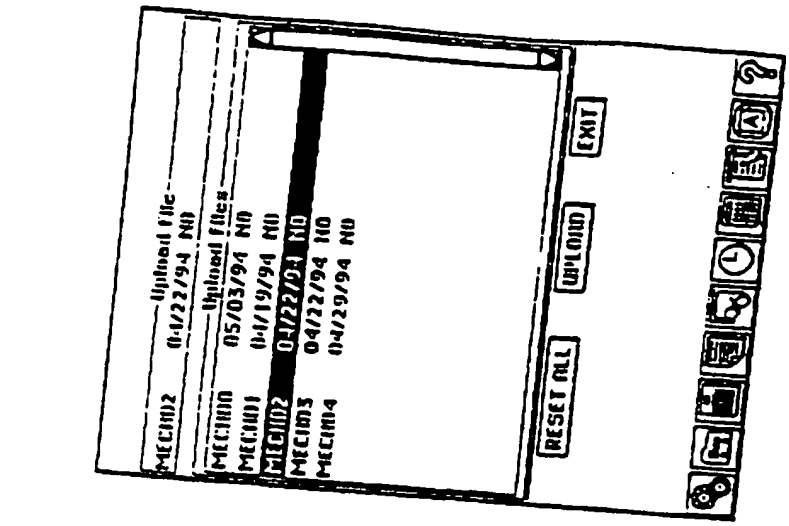


Fig 4F

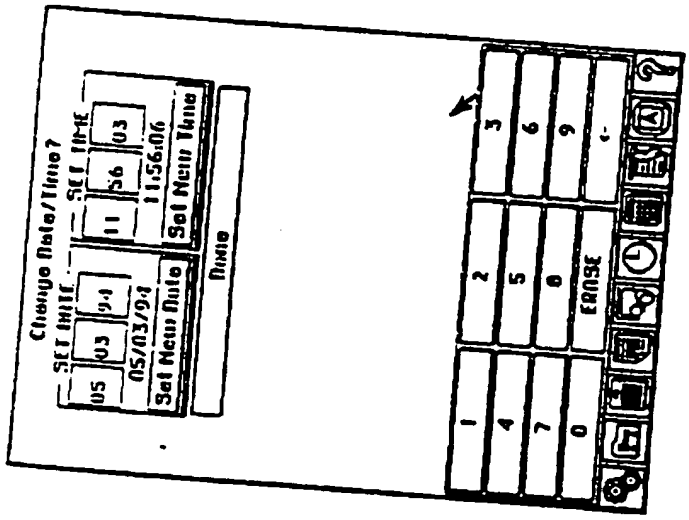


Fig 4E

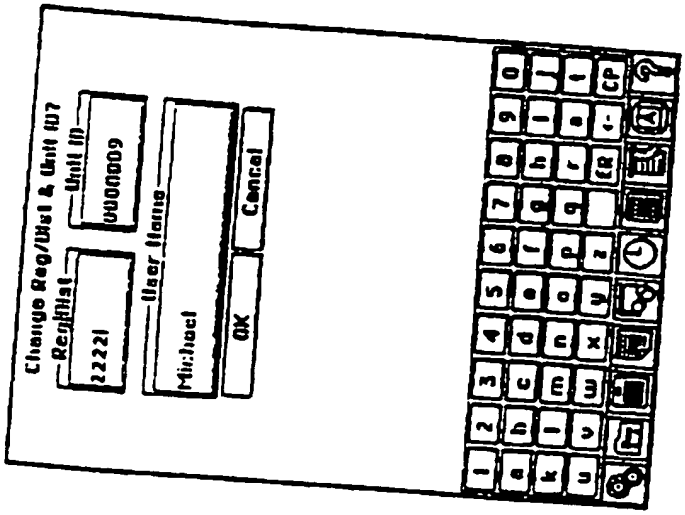


Fig 4D

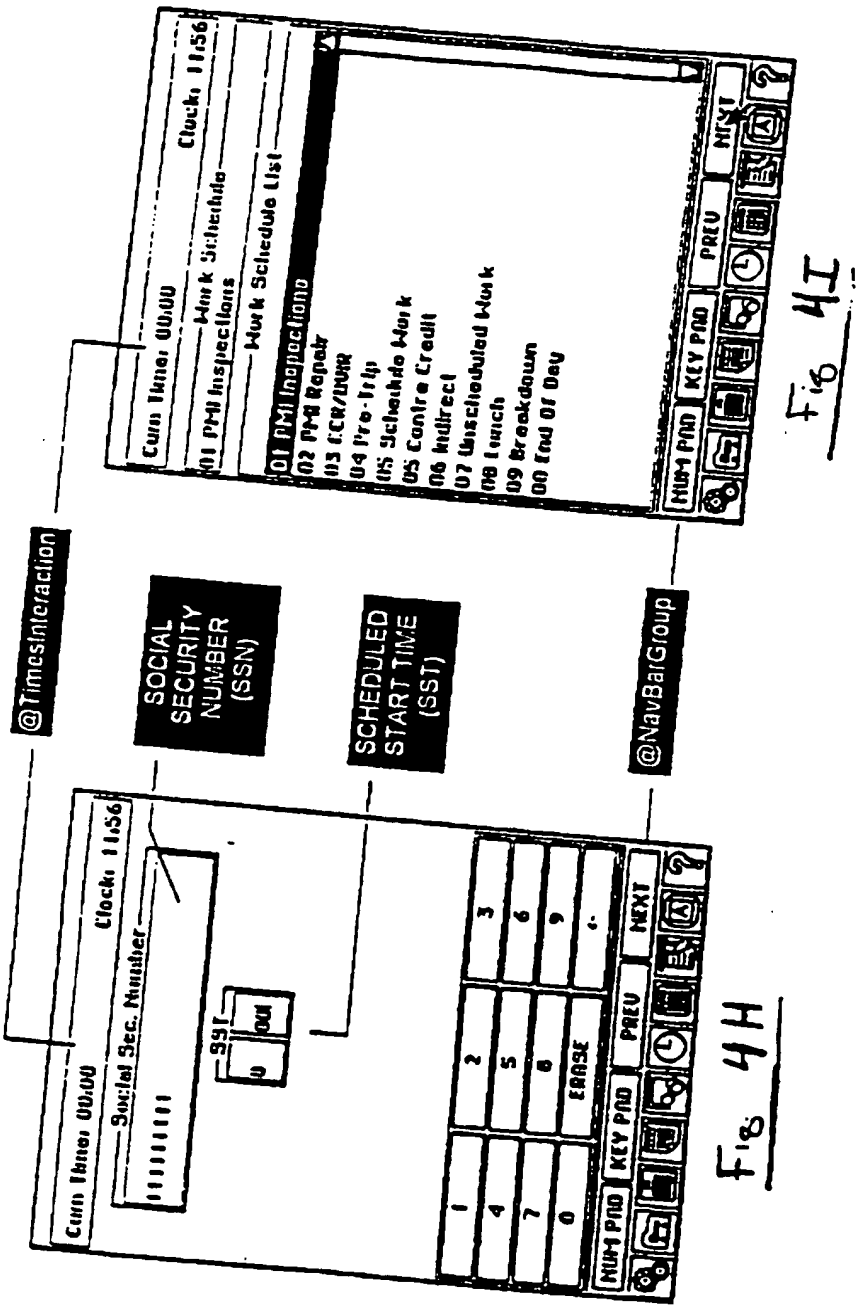

@TimesInteraction
SOCIAL SECURITY NUMBER (SSN)
SCHEDULED START TIME (SST)
@NavBarGroup
Curr Time: 00:00
Clock: 11:56
Work Schedule List
01 PM Inspections
02 PM Repair
03 ECR/SWR
04 Pre-Trip
05 Schedule Work
06 Indirect
07 Unscheduled Work
08 Lunch
09 Breakdown
00 End Of Day
NUM PAD
KEY PAD
PREV
NEXT
Social Sec. Number
SSN
Load
ERASE

Fig 4I

Fig 4H

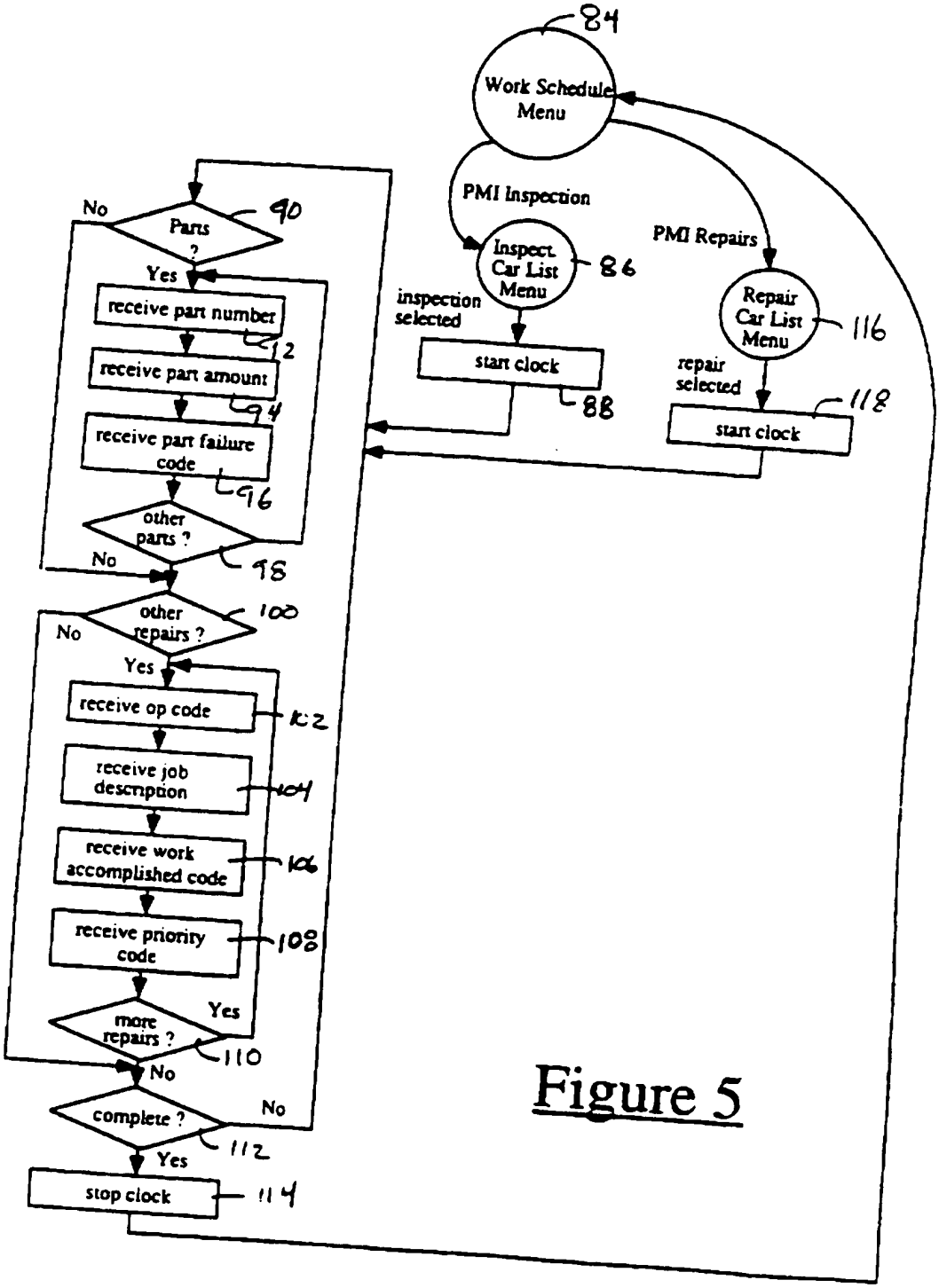

84
Work Schedule Menu
PMI Inspection
PMI Repairs
Inspect Car List Menu
86
Repair Car List Menu
116
inspection selected
start clock
88
repair selected
118
start clock
No
Parts ?
90
Yes
receive part number
92
receive part amount
94
receive part failure code
96
other parts ?
98
No
other repairs ?
100
No
Yes
receive op code
102
receive job description
104
receive work accomplished code
106
receive priority code
108
more repairs ?
Yes
110
No
complete ?
No
112
Yes
stop clock
114

Figure 5

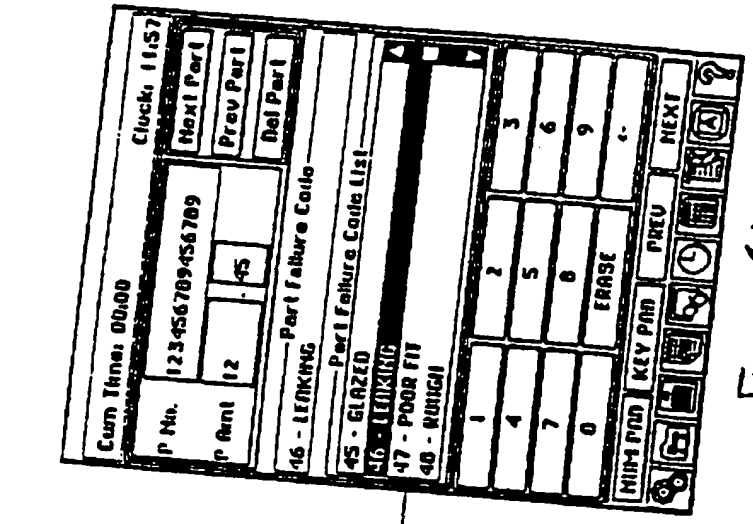


Fig 6C

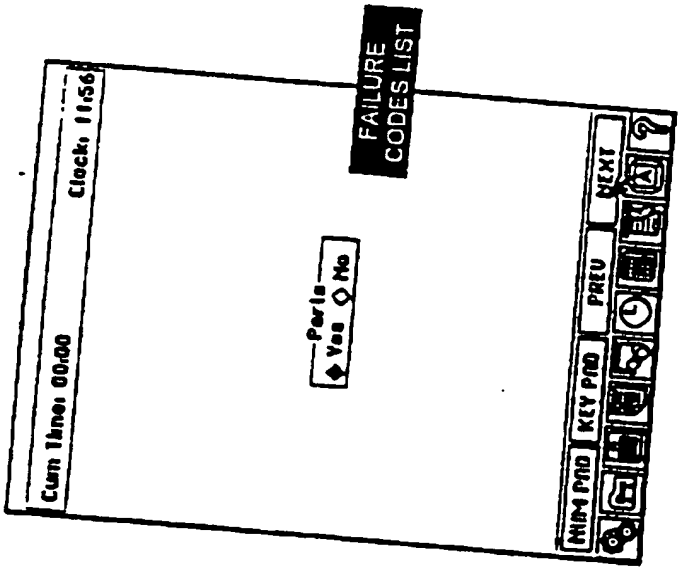
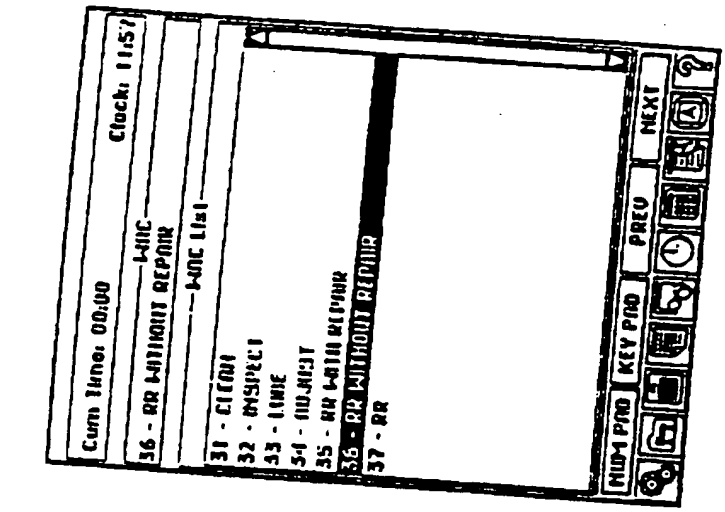


Fig 6B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Clock: 11:57
Job List
031 - CLEAN
032 - INSPECT
033 - LUBE
034 - ADJUST
035 - RR WHEEL REPAIR
036 - RR WITHOUT REPAIR
037 - RR
NUM PAD
KEY PAD
PREV
NEXT

Fig. 6G

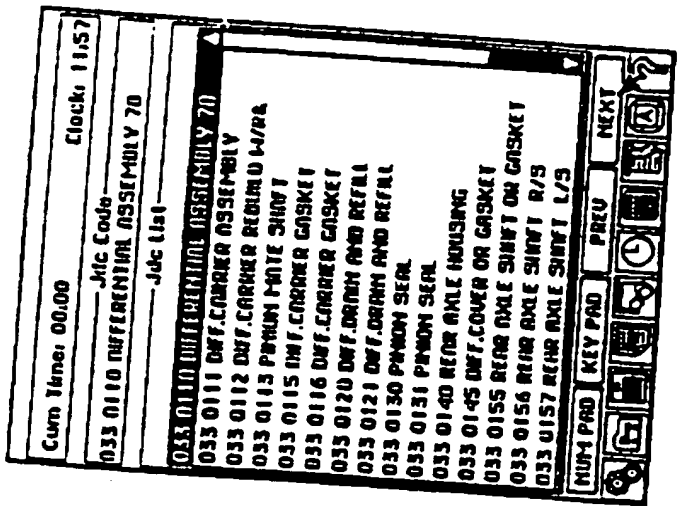
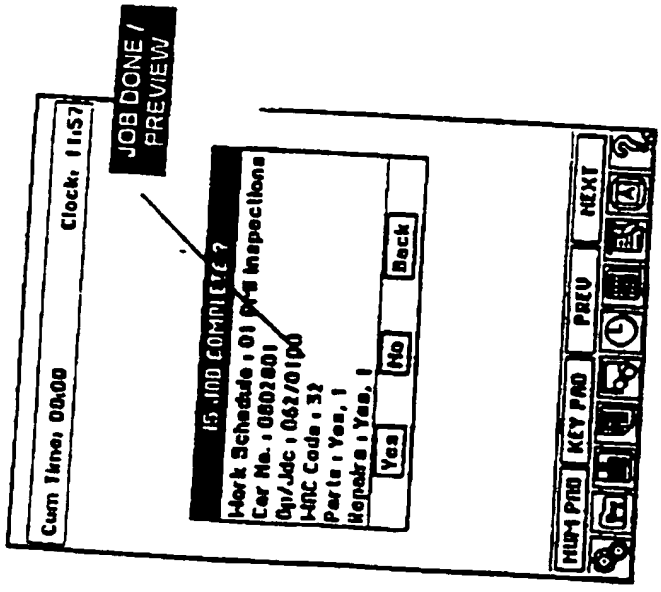

Curr Time: 00:00
Clock: 11:57
Job List
033 0110 DIFFERENTIAL ASSEMBLY 70
033 0111 DIFF.CARRIER ASSEMBLY
033 0112 DIFF.CARRIER REBUILD W/PA
033 0113 PINION MATE SHAFT
033 0115 DIFF.CARRIER GASKET
033 0116 DIFF.CARRIER GASKET
033 0120 DIFF.DRAIN AND REFILL
033 0121 DIFF.DRAIN AND REFILL
033 0130 PINION SEAL
033 0131 PINION SEAL
033 0140 REAR AXLE HOUSING
033 0145 DIFF.COVER OR GASKET
033 0155 REAR AXLE SHAFT OR GASKET
033 0156 REAR AXLE SHAFT R/S
033 0157 REAR AXLE SHAFT L/S
NUM PAD
KEY PAD
PREV
NEXT

Fig. 6F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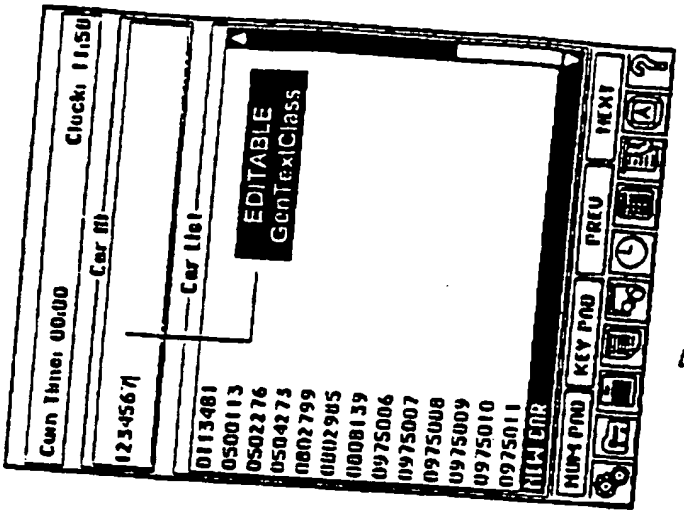
Clock: 11:57
Cum Time: 00:00
Work Schedule : 01
Car No. : 0801801
Qty/Jdc : 062/0100
WIC Code : 32
Parts : Yes, 1
Repairs : Yes, 1
Yes
No
Back
NUM PAD
KEY PAD
PREV
NEXT

Fig. 6J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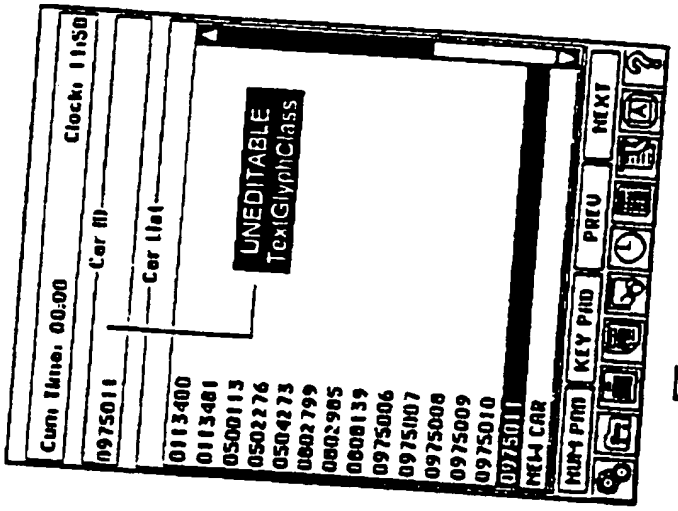
Clock: 11:50
Car ID
Car List
1234567
EDITABLE
GenTextClass
0113481
0500113
0502276
0504273
0802799
0802985
0808139
0975006
0975007
0975008
0975009
0975010
0975011
NEW CAR
NUM PAD
KEY PAD
PREV
NEXT

FIG. 8B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Car List
0975011
UNEDITABLE
TextGlyphClass
0113400
0113481
0500113
0502276
0504273
0802799
0802985
0808139
0975006
0975007
0975008
0975009
0975010
0975011
NEW CAR
NUM PAD
KEY PAD
PREV
NEXT

FIG. 8A